

Brick-by-Brick: Can We Use Plastic's Second Life to Build a Sustainable India?

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Abstract

Plastic pollution in India is escalating, exacerbating environmental and health issues. It is a common issue worldwide. While plastic pollution is increasing, there is a global trend toward using plastic in construction, particularly concrete and brick-making. This innovative approach offers a potential solution to plastic waste management and construction challenges. Existing research supports that plastic bricks are superior for construction due to their lighter weight and enhanced strength compared to traditional clay bricks (Chauhan et al., 2019; Mundhe & Dhawale, 2018). While countries like Indonesia and several African nations are already implementing plastic bricks, India is focusing on reducing plastic waste under the Improved Plastic Waste Management (IPWM) scheme, aiming to cut plastic waste completely and increase recycling by more than 60% by 2035. We also want to highlight how heavy construction in land-sensitive area is increasing Landslides every year.

With this paper, we want to explore how India can integrate these global techniques in construction to address its pressing environmental issues. By implementing plastic brick-making, India can reduce the burden of plastic waste and manage land resources more effectively. Our research, supported by a review of existing studies, indicates that plastic bricks can significantly alleviate land pressure. This method has the potential to mitigate landslides and minimize the pollution from plastics. By adopting plastic brick technology, India could not only address environmental concerns but also advance toward sustainable development.

Keywords: Plastic Pollution, Sustainable Construction, Plastic Bricks, Waste Management, Land Pressure Reduction, Environmental Solutions

Introduction

Background

Our planet is plagued with millions of metric tons of plastic waste., choking landfills and oceans. This issue has grown significantly since the 1950s, a period marked by a dramatic increase in worldwide production of plastics, often with inadequate regulatory oversight (Hazlegreaves, 2021). The early adoption of plastics can be seen in iconic examples such as the US flag used in the Apollo 11

mission of 1969, which was made from nylon, a type of plastic fiber. By the 1970s, the popularity of plastic products soared, driven by their numerous benefits over traditional alternatives (Andrady & Neal, 2009). However, back in today's time, the disadvantages of plastic cannot be ignored, prompting global action to reduce its usage. In recent studies, Microplastics have been found in biological samples, entering animal bodies through the food chain, and posing serious health risks to humans (Osman et al., 2023; Parker,

2023) whereas Single-use plastics, designed for immediate disposal, are pervasive in modern life. From food and beverage packaging like bags, bottles, cups, and cutlery to personal care items such as cotton swabs, razors, and toothbrushes, these products contribute significantly to plastic pollution. Other culprits include shopping bags, straws, stirrers, and various forms of packaging for electronics and toys. Most of the sea waste includes single-use plastics and microplastics. Single-use plastic bags are a major source of pollution, clogging landfills, and wreaking havoc on sewerage systems. The resulting inefficiency significantly increases costs for utility operations (Qari & Shaffat, 2015). Plastic bags have been in the lead of intense controversy due to their devastating environmental consequences, involving the formation of plastic garbage in oceans, posing a lethal threat to countless marine organisms (Nigar 2019a; Nigar 2019b). Plastic has contaminated every facet of animal existence, impacting the natural lifecycle severely. Most wild animals, birds, and fish consume plastic waste mistaking it for food, which hampers the natural starvation cycle of these animals (National Geographic). About 75% of the sea waste comes from plastic affecting marine life significantly (Zhang et al., 2021). Discarded plastic items like fishing nets and six-pack rings entangle marine animals, impairing their movement, causing injuries, and even leading to death. Harmful chemicals (BPA, and phthalates) present in plastics, when ingested, can disrupt animal's hormonal balance and affect their reproductive health (D., 2023).

A large quantity of plastic waste gets burned or ends up in landfills and the ocean, despite the best recycling technologies. Although there is a rising movement to limit plastic consumption, cultural norms, and convenience continue to be obstacles (Joe, 2022). Based on Oceana USA (2024) estimates, 33 billion pounds of plastic enters the oceans every year. According to WWF (2024),

60% of the annual production of virgin plastic (430 million tonnes) is mostly caused by single-use plastics, and of all the plastic ever produced, only 9% has been recycled. Despite nearly 95% of UN members showing interest in a global plastic treaty (Selamat, 2022), 85% of people globally support a single-use plastic ban (WWF, 2024). Even with overwhelming public support for plastic reduction, plastic production is projected to triple by 2050 compared to 367 million metric tons manufactured in 2020 (Parker, 2023). According to, Ocean Conservation (2020), 10.8 to 11.5 billion metric tons of CO₂ emissions may be avoided and approximately 2.6 billion plastic metric tonnes could be eliminated if single-use plastics were reduced by 50% by 2050. Marine plastic pollution also poses a significant economic burden. By degrading coastal aesthetics and disrupting tourism, it erodes revenue streams. Additionally, it jeopardizes critical industries such as shipping, fishing, and aquaculture through vessel damage, habitat destruction, and the spread of invasive species (Jang et al., 2014; Hardesty et al., 2015; Sivan, 2001).

Global Innovations in Plastic Waste Recycling

Some countries are actively leading the charge in addressing plastic pollution and implementing effective reduction strategies. For example, Germany's bottle deposit scheme, known as the Pfand system (Bouliane & Bouliane, 2024), is a really successful environmental initiative. When purchasing beverages in bottles or cans, customers pay a deposit that is repaid when the empty containers are returned. The program has successfully reduced trash and encouraged recycling, achieving an impressive return rate of over 98%. Whereas single-use bottles are recycled into new products, refillable bottles are cleaned and used again. This process conserves raw materials, saves energy, and reduces CO₂ emissions (Ruiz & Cwienk, 2021). But the numbers do not mean it's all going to be fine. According to PWMI - Plastic Waste Management Institute (2021), Japan still has

a serious plastic waste problem because of the large production and consumption of single-use plastics, even with a high plastic recycling rate of 87% in 2021.

We can take some international examples of how we can recycle more from plastic waste, benefiting a country economically. The integration of recycled plastic into everyday consumer goods is a burgeoning trend, reflecting a growing consciousness about environmental impact. From fashion and home goods to technology, toys, 3D printing, and construction, discarded plastic is being recycled by innovative companies into useful and fashionable goods. Apparel brands like The Sak and Team Timbuktu are incorporating recycled materials into bags, activewear, and swimwear, keeping plastic garbage out of landfills. Home decor is also seeing a green makeover, with companies like Polywood and Fab Habitat creating furniture and rugs from recycled plastic. Even tech giants are joining the movement, as evidenced by Lifeproof's eco-friendly phone cases made from ocean-bound plastic. The 3D printing industry is also embracing recycled plastic, with companies like Refil and Filamentive producing 3D printer filament from discarded plastic bottles and other waste materials. This not only helps reduce plastic pollution but also provides a sustainable source of material for innovative and customizable manufacturing.

Within the construction industry, recycled plastic is being used to create durable building materials. Companies like ByFusion and Platío are converting plastic trash to build blocks and paving tiles. Plastic bricks are gaining popularity because they offer several advantages: they are lightweight, durable, resistant to weather and chemicals, and provide excellent insulation. Moreover, utilizing plastic bricks decreases the effects on the environment of construction projects and offers a cost-effective substitute for conventional construction materials.

India's Plastic Waste and Environmental Crisis

In India, nearly 26,000 tons of plastic waste are generated each day, making it one of the top 12 countries responsible for generating 60% of the world's plastic waste, with China and the USA leading the list (Rana, 2019; Mukherjee, 2024). According to Statista (2023), more than 320 landfills exist in India. Research by Alam et al. (2020) shows the negative impact of these landfills on the surroundings and groundwater. According to Managing Plastic Waste in India: An agenda for action. (2020), in India, about 5-6% of solid waste comes from plastic, and data from 2019 suggest 60% of that plastic waste gets recycled (Kapur-Bakshi et al., 2021). But 60-70% of recycling applies to valuable plastics only, the real number is around 8% (Dhodapkar et al., 2023). This recycling rate is significantly low if we compare it against the previous examples. Thus, the government must take action to fix this issue.

Under the new Improved Plastic Waste Management (IPWM) scenario, The Indian government wants to decrease the number of single-use plastics by 20% by 2025, and 50% by 2030, and completely phase them out by 2035. The goal is to raise recycling rates from 13% in 2025 to 67% in 2035. It is possible to cut landfill trash by 10% by 2025 and 30% by 2035. Coherent collection systems and significant changes in the behaviors of companies and families might reduce waste streams that are poorly managed or unmonitored by 30% by 2025 and up to 80% by 2035 (Dhodapkar et al., 2023). However, we don't want to limit the research to plastic recycle only. India also faces the growing risk of landslides due to over-construction, particularly in vulnerable regions like the Himalayas. The destabilization of slopes due to over-construction is a major factor in increasing landslide risk. Activities such as heavy building construction, hill slope cutting, road widening, and blasting for tunnels and hydro projects are key triggers (Kazmi et al., 2016; Tanyas et al., 2020). Consequently, India is highly

vulnerable, with 17,120 landslide-prone sites, including 675 near critical infrastructure. The Landslide Atlas of India 2023 highlights high-risk districts such as Rajouri, Thrissur, Pulwama, Palakkad, Malappuram, South Sikkim, East Sikkim, and Kozhikode (Lalit Maurya, 2023). From 1998 to 2022, India recorded nearly 80,000 landslides, with Mizoram leading at 12,385 incidents, followed by Uttarakhand (11,219), Tripura (8,070), Arunachal Pradesh (7,689), Jammu and Kashmir (7,280), Kerala (6,039), Manipur (5,494), and Maharashtra (5,112). These figures highlight the widespread and persistent landslide threat across the country (Lalit Maurya, 2023). In 2024 alone, Uttarakhand faced over 1,100 landslides and nearly 100 deaths by July. Between 2015 and 2023, landslides claimed around 300 lives in the state. The ongoing Char Dham Road construction in Uttarakhand exacerbates the issue by disrupting the fragile Himalayan ecosystem. This project loosens soil and increases landslide vulnerability, particularly during heavy rainfall, amplifying the region's landslide risks (Talwar & India, 2023).

Problem Statement

India is facing a dual crisis of escalating plastic waste and increasing environmental vulnerabilities, particularly in regions prone to landslides. Despite efforts to manage plastic waste, India still struggles with high volumes of single-use plastics, much of which ends up in landfills or the environment. Current recycling rates remain low, and improper waste management contributes to severe ecological problems. Simultaneously, landslides have become a significant hazard across many regions, exacerbated by over-construction, deforestation, and infrastructure projects. The destabilization of slopes from heavy building activities and natural erosion makes many areas susceptible to landslides, particularly during monsoons. With three major landslide-prone locations (Northeastern, Himalayan, Western

ghats) across the country, urgent action is required to mitigate these risks (Vinoth, 2024).

This research aims to explore how recycled plastic bricks can address both these critical issues. By utilizing plastic waste in the production of durable, weather-resistant bricks, India can reduce its reliance on conventional building materials, cut down on plastic pollution, and provide a sustainable solution for constructing infrastructure in areas vulnerable to landslides. Plastic bricks have the potential to not only decrease the environmental footprint of construction projects but also contribute to the stabilization of slopes, offering an innovative approach to reducing land pressure and improving safety in landslide-prone regions.

This study will evaluate the technical and economic feasibility of plastic bricks as a building material and assess their potential to reduce both plastic waste and landslide risks in India.

Objective

This study aims to evaluate the feasibility and advantages of incorporating recycled plastic bricks into India's construction sector. By focusing on technical, economic, and social dimensions, the research seeks to assess the potential of plastic bricks to address critical issues such as plastic waste and landslide risks. The objectives of the study include:

- **Assess Material Properties:** Investigate the technical attributes of plastic bricks, including their strength, durability, and environmental impact, in comparison to conventional construction materials.
- **Evaluate Manufacturing Processes:** Analyse the production methods for plastic bricks, including technological requirements, scalability, and cost-effectiveness.
- **Explore Environmental and Economic Benefits:** Examine how plastic bricks can

mitigate environmental issues, such as reducing plastic waste and land pressure in vulnerable regions, while contributing to sustainable and cost-efficient construction practices.

- **Assess Feasibility and Business Viability:** Evaluate the potential for developing a business model around the production and distribution of plastic bricks, focusing on their application in land-sensitive areas to enhance infrastructure stability and promote eco-friendly construction.

Literature Review

For years, researchers have been looking into the possibility of using plastic trash as a useful resource for the construction sector, aiming to create eco-friendly and affordable building materials (Saikia & De Brito, 2012; Ojeda, 2021; Siddique et al., 2008). Studies have suggested that recycling waste plastic for use in construction could be both profitable and environmentally beneficial, contributing to a circular economy model (Syberg et al., 2021; Ahmed, 2023).

Nzambi Matee, a Kenyan innovator, has altered the value chain for plastic by upcycling discarded plastic into construction materials through her company, Gjenge Makers. This pioneering approach not only addresses plastic pollution but also meets the growing demand for building materials (Mwenda, 2023). Matee's journey began with an understanding of her city's plastic trash problem, which she tackled using her materials engineering background and passion for sustainability. Gjenge Makers exemplifies how innovation and determination can combat the challenge of plastic waste. Similarly, Rebricks, an Indonesian company, is advancing sustainability by recycling single-use plastic waste into mixed plastic bricks (Taylor, 2023). Inspired by these successful models, our purpose is to investigate

how plastic bricks could address India's challenges related to plastic waste and construction needs.

There are other examples like, Jijangae Makers, a Kenyan company, effectively tackles plastic waste by repurposing materials like bottles and bags to produce durable bricks. These bricks have been used to construct schools, homes, and other vital structures, significantly contributing to both waste reduction and affordable housing solutions (Mwenda, 2023). Similarly, Conceptos Plásticos, a Colombian enterprise, manufactures interlocking plastic bricks resembling oversized Lego pieces. These bricks are used for building schools and community infrastructure, offering a sustainable and practical solution to Colombia's mounting plastic waste challenge (Annalisa, 2021; TRANSFORM Survive & Thrive, 2024). In South Africa, the Centre for Regenerative Design and Collaboration (CRDC) is refining a process that transforms discarded plastic waste into robust construction materials. Their innovative bricks, called EcoArena PRA (Pre-conditioned Resin Aggregate), present a groundbreaking method for addressing the country's plastic waste crisis. Costa Rica's Pedregal company has previously implemented similar plastic bricks in construction projects, and CRDC is collaborating with Dow, a leading US chemical manufacturer, to further develop the EcoArena blocks. This partnership is pioneering the upcycling of plastic waste into sustainable building materials, offering a forward-thinking solution for both waste management and construction (WaysTo.Digital, 2019; Africa, 2021; Technology, 2019).

Reusing plastic waste to create cement composites is one possible way to address the plastic waste problem, offering economic and environmental benefits. Various studies have investigated the use of different types of plastic trash, such as bottles made of PET, PVC pipes, and HDPE, as components in concrete to develop new, sustainable building materials (Akçaözoglu et al., 2010; Kou et al., 2009; Asokan et al., 2010).

Beyond cement, Halimi (2017) introduced a composite material combining polyester resin and mineral fillers, showing potential for both construction and ceramics applications. Moreover, Haque (2019b) suggested that plastic bricks made from recycled PET containers could offer an eco-friendly and affordable solution for building shelters in refugee camps, such as those for the Rohingya people in Bangladesh, effectively addressing accommodation needs as well as dealing with plastic junk. These bricks, composed of PET mixed with foundry sand or recycled glass, have demonstrated significantly higher compressive strength and require much lower production temperatures compared to traditional clay bricks (Aneke & Shabangu, 2021; Ikechukwu & Shabangu, 2021).

Methodology

This review systematically examines how India can integrate global plastic brick-making techniques to address both plastic pollution and the growing risk of landslides in land-sensitive areas. To achieve this, a comprehensive literature review was conducted using databases such as Google Scholar, and Scopus, as well as relevant online articles. Keywords including "plastic pollution," "plastic bricks," "sustainable construction," and "landslides" were employed to identify pertinent studies. The review focused on peer-reviewed articles published between 2010 and 2023, specifically highlighting the environmental and structural advantages of plastic bricks. Furthermore, the analysis synthesizes findings to demonstrate how plastic bricks can significantly reduce plastic waste, alleviate land pressure, and contribute to landslide mitigation, thereby underscoring their potential for widespread adaptation in India's construction sector.

Types of Plastic and its usages

Type of Plastic (Waste)	Characteristics	Usage (Waste Origin)
Polyethylene Terephthalate (PET)	Smooth, transparent, thin, anti-inflammatory, prevents oxygen ingress. Can leach toxic additives if heated.	Water bottles, juice, mouthwash, vegetable oil, soft drinks, margarine, and disposable salad dressing. Generally, for single use.
High-Density Polyethylene (HDPE)	Heat-resistant, made from petroleum, no phthalates or BPA, considered safe but can be harmful with long sunlight exposure.	Plastic shopping bags, toys, milk jugs, refrigerators, and detergent bottles.
Polyvinyl Chloride (PVC)	Heat-resistant and poisonous because of BPA, phthalates, dioxins, and heavy metals. Flexible due to phthalates.	Packaging for fruit juice, and cooking oil. Usage has decreased due to health and environmental risks.
Low-Density Polyethylene (LDPE)	Heat-resistant, fragile, flexible, rigid. Safe for beverages and food.	Packaging for milk, frozen foods, and juices.
Polypropylene (PP)	Strong, semi-transparent, heavier, and stronger than polyethylene. No harmful substances.	Packaging for medicine, yogurt, ketchup, and beverages.
Polystyrene (PS)	Contains carcinogenic benzene. Hazardous health effects from long-term exposure.	Insulators, packaging materials.
Polycarbonate (PC)	It contains BPA, which can leach into food or drinks when exposed to high temperatures.	Reusable bottles. Usage has decreased due to health risks associated with BPA.

Table 1 Types of Plastic and its Usages

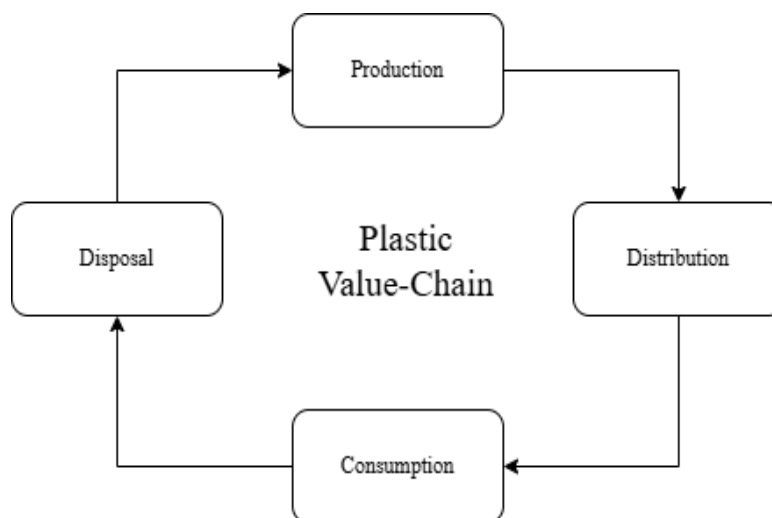


Chart 1 Plastic Value-Chain

Plastic Value-Chain and Plastic Reduction

Some Innovative approaches like additive manufacturing (AM) for recycling plastic waste can effectively reduce waste and pollution in the plastic value chain (Rajabi-Kafshgar et al., 2024; Kassab et al., 2023). Establishing Closed-Loop Supply Chain (CLSC) networks to repurpose plastic bottle waste and 3D printing byproducts can provide significant environmental, social, and economic benefits (Rajabi-Kafshgar et al., 2024).

Here are the steps that make up the plastic value chain (Tracextech, 2023):

- **Production:** Fossil fuels are extracted and converted into petrochemicals, which are then transformed into plastic resin (this resin is also made from recycled plastics).
- **Distribution:** Plastic products are transported to various industries.
- **Consumption:** Plastics are used in packaging, consumer goods, construction, and other sectors.
- **Disposal:** Used plastics are either recycled or sent to landfills, with growing concerns about environmental impact.

Optimal Plastic Types for Brick Manufacturing

Polyethylene terephthalate (PET) stands out as an ideal material for brickmaking due to its environmental benefits and properties. PET bottles, a significant contributor to plastic waste (Sidar et al., 2024), can be cleaned, blended with sand in various ratios, and used to produce high-quality bricks with excellent acoustic and thermal insulation. This process addresses the non-biodegradability of plastic while reducing both construction costs and pollution (Sidar et al., 2024). PET waste has shown promising results in non-conventional brick production, with grey relational grade values ranging from 2.384 to 3.045 (Maddodi et al., 2022). Additionally, interlocking bricks made from a PET/Polyurethane (PU) ratio of 60/40 are well-suited for non-load-bearing masonry (Alaloul et al., 2020). Low-density polyethylene (LDPE) bags have also been used to produce high-strength bricks with excellent thermal and sound insulation properties, further contributing to pollution control and cost savings (Kadhane et al., 2022).

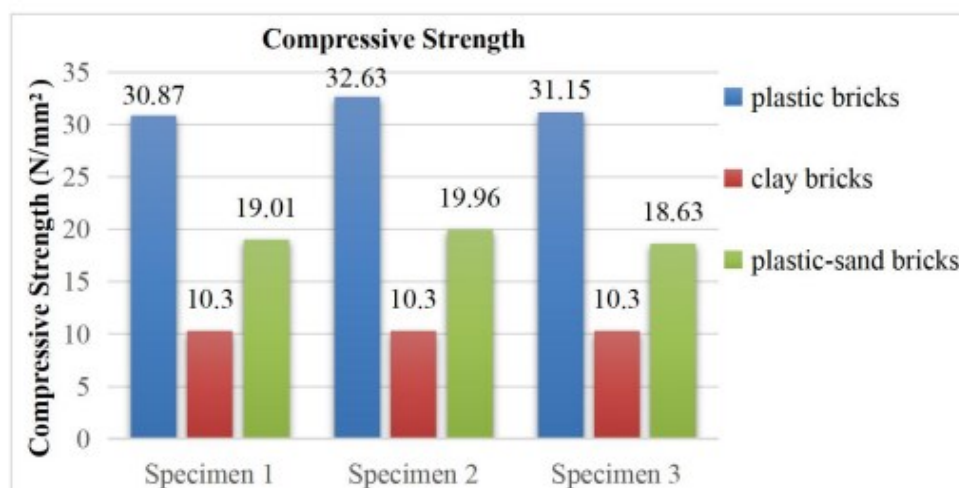


Chart 2 Comprehensive Strength (Biradar et al., 2024)

According to Biradar et al. (2024), plastic bricks outperform clay bricks in several aspects, including strength, thermal behaviour, water absorption, fire resistance, and cost. The key highlights of their study include:

- **Strength:** Plastic bricks have 200% more compressive strength than clay bricks.
- **Thermal Shrinkage:** Plastic bricks shrink less (9.83%) compared to clay bricks (13.66%).
- **Water Absorption:** Plastic bricks absorb significantly less water (1.53%) compared to clay bricks (15%).
- **Fire Resistance:** Plastic bricks covered with aluminium resist higher temperatures (630°C) than clay bricks (560°C).
- **Durability:** Plastic bricks show no efflorescence and are less prone to breaking.

Cost: Plastic bricks are 35% cheaper than clay bricks, and 15% cheaper even with aluminium covering.

The procedure of making plastic bricks –

The process of making plastic bricks follows a similar approach across different types of plastic-based bricks. It generally involves the following steps:

- **Segregation:** Collect and separate plastic waste from other materials.
- **Drying:** Ensure that any wet plastic waste is dried properly.
- **Shredding:** Reduce the plastic waste into small, fine particles.
- **Sieving:** Sieve stone dust to a size less than 4.75 mm.
- **Heating:** Heat both the stone dust and plastic waste separately until the plastic becomes liquid.
- **Mixing:** Thoroughly mix the heated stone dust with the molten plastic.
- **Moulding:** Pour the mixture into Moulds to shape the bricks.
- **Demoulding:** Allow the bricks to dry, then remove them from the Moulds the next day.



Images - Stages of Plastic Brick Production (Biradar et al., 2024)

In the production process described by Biradar et al. (2024), the plastic-to-stone dust ratio is 3:7, resulting in bricks that weigh 2.5 kg each. These plastic bricks are about 24% lighter than traditional Indian clay bricks, which typically weigh around 3.3 kg (Littlehampton Bricks, 2024). This makes plastic bricks a viable, lightweight, and sustainable alternative for construction.

Discussion

While excavation remains necessary for building foundations, the use of plastic concrete—with its lower density compared to conventional cement—has the potential to reduce land pressure by around 24% or more (Littlehampton Bricks, 2024). With India generating approximately 26,000 tons of plastic waste daily, utilizing plastic bricks could

help divert a significant portion of this waste from landfills, offering an eco-friendly alternative to traditional construction materials. Beyond the environmental benefits, transitioning to plastic bricks or concrete could also pave the way for a new economic sector, offering substantial job creation opportunities. However, for this transition to take place, several key steps are essential:

- **Initial investments** in plastic brick manufacturing plants.
- **Government incentives** and **public-private partnerships** to facilitate the shift.
- **Technological advancements** to optimize the efficiency of plastic brick production.
- **Adaptations to existing infrastructure** to effectively incorporate plastic bricks.

Simultaneously, India faces another pressing issue: landslides. The government has responded with initiatives like the National Landslide Risk Management Strategy (2019), the Landslide Risk Mitigation Scheme (LRMS), and efforts by the National Disaster Management Authority (NDMA) to mitigate these risks. Complementing these strategies, the Landslide Atlas of India offers detailed assessments of vulnerable areas. To address the increasing threat posed by human activity, environmental degradation, and natural processes, enhancing resilience to geohazards is crucial. Smart solutions, such as web-based sensors and integrated Early Warning Systems (EWS) that leverage AI and machine learning algorithms, can significantly improve risk prediction, enabling timely preventive measures for at-risk communities (Building Resilience against Landslides, Aug 2023).

Frequent and devastating landslides in India, particularly in regions like the Western Ghats and the Himalayas (Building Resilience Against Landslides, Aug 2023), underscore the limitations of traditional mitigation methods such as retaining walls, terracing, and afforestation. Plastic bricks present a promising alternative for landslide prevention due to their:

- **High compressive strength**, providing robust structural support.
- **Lighter weight** compared to traditional clay or concrete bricks, making them easier to transport to remote areas.
- **Low water absorption and strong heat resistance**, ensuring durability and stability across varying weather conditions, which helps reduce material degradation over time.

As the challenges of plastic waste accumulation and increasing landslide incidents grow, innovative and sustainable solutions are urgently needed. Plastic bricks offer a dual solution:

- **Mitigating plastic waste** by diverting it from landfills.
- **Reducing land pressure** in landslide-prone areas by replacing traditional, heavier clay bricks with lightweight plastic alternatives.

According to Arbanas and Dugonjić (2010), construction activities in sensitive land areas, such as building highways or extracting natural minerals, are major contributors to landslides (Sharma & Prakash, 2023; Prasad, 2023). Additionally, densely populated areas significantly increase the risk of landslides (Luo et al., 2019).

Plastic bricks offer several long-term environmental advantages:

- **Reduced energy consumption:** Plastic bricks require less energy to produce compared to traditional clay bricks, resulting in a lower overall environmental impact.
- **Recyclability:** At the end of their functional life, plastic bricks can be recycled, supporting a circular economy and minimizing waste.
- **Reduced landfill waste:** By repurposing plastic waste, these bricks help decrease the volume of plastic that would otherwise accumulate in landfills.
- **Lower carbon footprint:** The production of plastic bricks generates fewer greenhouse gas emissions than the manufacturing of traditional clay bricks.

To promote the adoption of plastic bricks:

- **Implement tax breaks:** Offer tax incentives for plastic brick manufacturers to reduce production costs and encourage investment.
- **Set mandatory quotas:** Require a certain percentage of government construction projects to use plastic bricks.
- **Provide low-interest loans and grants:** Support companies establishing plastic brick manufacturing plants and investing in R&D through financial assistance.

- **Launch awareness campaigns:** Educate the public and the construction industry on the environmental and structural benefits of plastic bricks.

One advantage of using plastic bricks is that they reduce the likelihood of landslides., conserve resources, stimulate the economy, and address plastic pollution, providing a thorough and long-lasting solution to India's development problems.

Why Plastic Bricks Outshine Traditional Materials

The integration of plastic waste in brick production has emerged as one of the promising solutions, offering both economic and environmental benefits. Specifically, plastic waste utilized in the brick-making process can be swapped whole or in part. (Yusof, 2018). According to cutting-edge research, plastic bricks can equal or even outperform conventional clay bricks in terms of compressive strength. Created using sand and waste plastic, these bricks often exceed conventional durability. Bricks made of polypropylene (PP) and high-density polyethylene (HDPE) are as sturdy as premium bricks, with HDPE being the strongest. Additionally, bricks produced from thermoplastic granules derived from non-recyclable waste perform similarly or better. (Shrestha et al., 2023; Kulkarni et al., 2022; O et al., 2022; Baisakhi.D & Acamma, 2023).

The resulting plastic sand bricks are more cost-effective than traditional clay bricks, which eventually helps to rid the environment of plastic waste (User, 2019). Remarkably, studies have consistently demonstrated that these plastic blocks show exceptional compressive strength compared to their traditional clay counterparts (Chauhan et al., 2019; Mundhe & Dhawale, 2018). This superior physical property, coupled with their competitive performance in other aspects such as compressive strength, positions plastic bricks as a viable alternative to ordinary bricks (Al-Sinan &

Bubshait, 2022). The bricks produced using plastic waste boast desirable characteristics, including lightweight construction, smooth surfaces, fine edges, an absence of cracks, and exceptional crushing strength (Kumar Biswas & Nath, 2020). These attributes not only render them suitable for construction applications but also contribute to mitigating environmental pollution by repurposing plastic waste (Al-Sinan & Bubshait, 2022; Kumar Biswas & Nath, 2020). In addition, using plastic waste in the making of bricks provides a sustainable way to dispose of plastic trash, promoting waste management, energy efficiency, and sustainability in the construction sector as a whole (El-Metwally et al., 2023; Anusha & Kumar, 2023).

Plastic bricks are eco-friendly and sustainable, reducing carbon footprints and managing non-biodegradable waste. Their production conserves natural resources, lowers costs, and reduces pollution. Structurally, they provide high compressive strength, minimal water absorption, and thermal resistance, making them versatile for various applications. They also improve thermal insulation, which helps buildings use less energy. Plastic bricks are a strong substitute in the construction sector because of their advantages for the environment and structure (Johnson et al., 2024; Sidar et al., 2024; Yasira et al., 2024).

Conclusion

In summary, this study examined how plastic bricks may be used to help India's urgent problems of reducing plastic waste and preventing landslides. The study highlights the significant challenges posed by landslides, which have become a recurrent and devastating problem, especially in the Western Ghats and Himalayan areas (Building resilience against landslides, Aug 2023). Nevertheless, there can be regulatory obstacles to the use of plastic bricks., as policymakers and building authorities may need to revise existing construction codes and standards to

accommodate this new material. Convincing the public to accept and trust the use of plastic bricks in construction, especially in areas prone to natural disasters, may require extensive awareness campaigns and demonstration projects (Singh et al., 2023; Al-Sinan & Bubshait, 2022). Furthermore, substantial spending on innovation and research may be necessary for the large-scale manufacture of high-quality plastic bricks to optimize the manufacturing process and guarantee the structural integrity of the finished product.

This research opens up new avenues for further investigation, examining the performance and long-term resilience of plastic bricks in several weather conditions, developing innovative recycling techniques for the end-of-life disposal of plastic bricks, and analyzing the broader effects on the environment and economy of this solution. From a business perspective, using plastic brick for construction offers a great opportunity and will likely spark the development of a new plastic brick manufacturing sector., which could drive investment, job creation, and the development of an eco-friendly supply chain for the handling of plastic waste.

Overall, the use of plastic bricks for construction, particularly in landslide-prone areas, offers a promising solution that can address multiple challenges simultaneously. Plastic bricks can improve India's resilience against natural calamities, reduce the strain on the land, and enhance the quality of life of its people by diverting plastic trash from landfills. Hence, addressing the identified challenges through targeted policy interventions, public-private partnerships, and continual research and creativity will be essential for the effective execution and widespread adoption of this innovative approach.

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